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Analysis of the livelihoods and the empowerment of peasant communities: an analysis of two rural areas in the department of Boyacá, Colombia

Abstract
The analysis of the livelihoods and the empowerment of rural communities has become one of the main strategies for characterising and studying rural communities, even more so when, in different parts of the world, these communities are strongly affected by the dynamics of politics and economics. The research aims to analyse the livelihoods and empowerment of two rural communities in the department of Boyacá in Colombia. To this purpose, two communities were chosen, one each from the municipalities of Ventaquemada and Jericó. A case study method was applied, with information being collected through semi-structured interviews with 24 family units. The results allowed significant differences to be found in the progress of the development of livelihoods, which was mainly associated with natural capital. In addition, it was also possible to distinguish differential features between the two study areas, which were associated with the social, economic, and physical environment, and therefore determined the degree of empowerment of family unit members in following a productive vocation in the rural sector.

Keywords
Capital • dynamics • economy • family nucleus

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Introduction

Colombia's Andean zone is characterised by the establishment of integrated agricultural systems in smallholding and family-type areas (Torres-Guevara 2002). In this way, local environments have focused on extractive models which have affected the sociocultural, environmental, and financial identity of most of the country's rural territories. Despite this crisis, these communities are a benchmark within the dynamics of the national economy, by contributing both to food security and sovereignty, and trade in agricultural products, mainly in localities (Berdegué et al. 2015). However, the lack of information on production systems in agriculture have made it difficult to identify the contribution which livelihoods have made to empowerment which favours the well-being of the producers and rural communities involved (Sharaunga & Mudhara 2016).

The study of livelihoods (ML) allows the identification of factors which contribute to the evolution of the abilities of communities – mainly rural – to satisfy their needs, as a strategy in the face of global dynamism (Jezeer et al. 2019). For this reason, interest in localities and their life experiences at the family, productive, and community levels is maintained in order to strengthen the construction of local identity through individual, community, and organisational leadership, as support for the sustainability of local communities (Plazas-Leguizamón & García-Parra 2017). One aspect which has been extensively studied seeks to establish a relationship between the technical, social, and accounting components of the different urban and rural communities, and to strengthen agricultural aspects where agroecological work prevails (Franco-Valencia & Sánchez de Prager 2018).

In this sense, it is relevant to highlight the actions which have been developed in the rural sector and which are articulated by sustainable livelihoods (Chambers & Conway 1992), especially with social, cultural, and environmental capital, which has been minimised by economic models focused on financial development. Currently, research which focuses on the analysis of rural communities addresses issues such as the transfer of technology in coffee crops (Suarez 2021), the cultural appreciation of landscapes around coffee cultivation (Velandia-Silva & Diab 2023), the economic and environmental performance of small producers in transforming exotic seeds from tropical forests, and socioeconomic determination in agricultural practices (Tatis-Diaz et al. 2022; Agudelo-Patiño et al. 2023), as well as the socio-ecological knowledge of indigenous communities and its importance through knowledge dialogue (Vásquez-Carrillo & Peláez-Ossa 2021).

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However, few contextualised analyses on the relationship between sustainable livelihoods and community empowerment are shared with local communities. For this reason, this research was developed in order to comprehensively address local aspects which can be evaluated through ML on a theoretical-practical basis; contribute to the holistic vision of local communities, mainly in Boyacá, where agroecological practices have allowed for the gathering of cultural, economic, environmental, and infrastructural factors (Eitzinger et al. 2012); consolidate the localities' real panoramas; and contribute to the resolution of conditions of rural vulnerability through the identification of weaknesses in and of opportunities for improvement in the formulation of new family farming strategies to reduce malnutrition as proposed by Ochieng et al. (2019), or, as proposed by Kmoch et al. (2018), by analysing the livelihood approach to the rescue of agroecological practices which face the effects of climate change on agricultural production.

In accordance with new productive dynamics for obtaining food, it should be taken into account that agroecological production systems are not implicitly more productive and efficient compared to monocultures or those of larger or smaller scale, because it is the integration of the design and management of resources which determines the productivity and efficiency (Gallardo-López et al. 2018). In this regard, there has been little focus on livelihood in the productive sectors from a perspective which allows the findings about peasant communities which develop their main activity in agriculture to be correlated, given that the greatest use of this approach focuses on topics such as the production of plant species which are of interest to forestry and their use (Castellanos-Navarrete et al. 2021), the monitoring of hunting and fishing (van Vliet et al. 2018), evaluating CO_2 reduction strategies (Blackman & Veit 2018), and mining (Franco & Ali 2017). These studies demonstrate the multifunctional strategies formulated to evaluate sustainability in different industrial systems, where the interaction of issues such as productive diversity become relevant through the dialogue of participatory knowledge in order to contribute to the development of human capacities and labour, production, and citizen participation, in the face of structural gaps in societies (Scoones 2009). In this context, this research aimed to characterise and analyse the livelihoods and empowerment of two rural communities in the department of Boyacá, Colombia.

Materials and Methods

The research was carried out using a qualitative methodology along with a case study method, and was developed in the way proposed by Vasilachis (2009). This approach is defined as empirical research, since it studies, in depth, a current situation within a delimited geographical region. Participatory methodologies were used to articulate the dynamics and methods; to make the most of data collection, its interaction, and analysis; and to guarantee the rigor, coherence, and validity of the sequential design. Using this context, the authors sought to integrate and discuss the inferences of the relationship between ML and rural empowerment according to local contexts, with an emphasis on the qualitative to explain the assumptions and give greater validity to the study, as established by Hernández-Sampieri (2014). Regarding the field methodology, this was based on a multi-site case study (Creswell & Poth 2017) carried out to detail the evolution of an interdisciplinary intervention in two communities, in relation to rural environments and processes. In this way, through the participation of families, the study aimed to establish the link which can exist between the categories of livelihood and empowerment (Stake 1999).

Case study selection

To carry out the research, two rural communities were chosen which are part of the macro project Artisans of Forgiveness, Reconciliation, and Peace, developed by the Archdiocese of Tunja, the Bank of the Republic, and the Juan de Castellanos University; these organisations have supported the development of agricultural activities to improve factors such as security and food sovereignty in Colombia's central zone. The work unit focuses on the municipalities of Ventaquemada and Jericó. The analysis of the municipalities required characterising their local environments through their particularities, such as the historical, social, cultural, environmental, and economic background specific to each of the studied regions; so that this research serves as a reference for other localities, as established by Otzen and Manterola, (2017).

Thus, the selected organisations were:

– The Community Action Board of Supatá village in the municipality of Ventaquemada, Boyacá (Colombia).
– The company Alfalfa de Colombia S.A.S. in the municipality of Jericó, Boyacá (Colombia).

These two study areas were selected for their locations, one in the centre and the other on the periphery of the department of Boyacá, Colombia, which are characterised by current activity in agricultural production.

Data collection instruments

For the fieldwork, semi-structured interviews were carried out as a direct research technique, and allowed the authors to interact with the producers on their farms and with their families. Each question had a direct relationship with issues of environmental, social, human, financial, and infrastructural interest, as proposed by López et al. (2015).

The results of the semi-structured interviews were systematised in order to quantify the capital which were chosen as analysis categories (López et al., 2015) and which were valued in each family based on each selection aspect (Table 1). For this purpose, they were weighted according to their incidence. In this way, one (1) was assigned as the minimum value in terms of access to assets, and three (3) as the highest availability. Then, for each type of capital, the scores were added together and then divided by the number of indicators. These averages were plotted on a pentagon, where the centre point corresponded to zero access to assets and the outer perimeter equalled maximum access.

To analyse the ML, an analysis of the main components was used for the five types of capital: human (HC), social (SC), natural (NC), physical (PC), and financial (FINC), in order to identify the relation between these types and to identify key aspects according to those relations, following the methodology proposed by Domínguez et al. (2014), with modifications.

Empowerment level

Through information on the economic, human, and socio-political resources obtained from the studied families, a diagnosis based on 'having', 'knowing', 'wanting', and 'being able to' was made, following a proposal by empowerment scientist Naila Kabeer (Kabeer 2002). The results of an evaluation of the above aspects are shown in Table 2 with their subcategories, where 1 corresponds to total disagreement; 2, disagreement; 3, agreement; and 4, total agreement; which were then totalled by subcategory and averaged by item (Charlier et al. 2007).

Statistical analysis

In the characterisation of the clusters, a bootstrap correlational analysis was carried which incorporates a double-entry correlation matrix for dendrograms using the Ward method, in order to establish groups of empowerment variables in such a way that the sum of the squares of the deviations, with respect to

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Table 1. Definition of capital and their evaluation aspects

Capital	Concept	Research selection aspects
Human	The ability of individuals to develop and improve resources through access to external resources and knowledge transfer.	• Training in associativity • Generational relief
Social	Related to the interaction between people and organisations to obtain positive or negative results.	• Local work networks • Link to projects • Link to policies
Natural	Natural resources associated with ecosystem goods and services.	• Water availability • Production area • Soil management (organic or conventional activities) • Biodiversity
Physical	Infrastructure which supports the production of goods or contributes to improving the quality of life.	• Access to land • Private infrastructure • Public infrastructure
Financial	Availability of financial resources to invest in the development of capacities for the consolidation of business units and accumulation of wealth for the future.	• Economic income • Family savings • Remittances • Credit

Source: adapted from Declerck et al. (2015) and Hernández-Núñez et al. (2021)

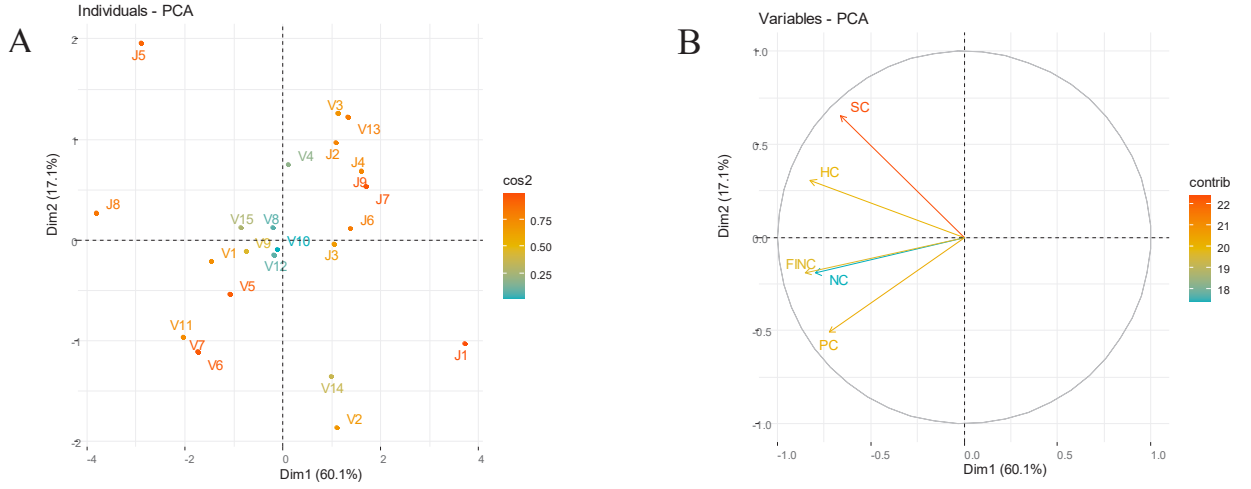

Figure 1. A: Correlation of the livelihoods of the families from Ventaquemada (V) and Jericó (J). B: human capital (HC), social capital (SC), financial capital (FINC), natural capital (NC), and physical capital (PC)
Source: own study

the mean of each variable, is minimal for all families. In this sense, the data was analysed using a heat map in order to facilitate an understanding of the relevant aspects which contributed to the empowerment of the population. To achieve this, the R program version 3.6.3 was used, with gplots and RColorBrewer libraries.

Results and Discussion

Correlation of ML in the municipalities

To determine the relation between Ventaquemada and Jericó, an analysis of the main components was carried out to establish the relation of the families to capital, so that the key families which stood out in regard to livelihoods could be identified as a basis for their empowerment. In this regard, in relation to Figure 1A, the coordinate points correspond to the analysed families, whereas, according to Domínguez et al. (2014), the number of components is equal to the number of analysed variables, and each component is made up of all the study variables.

In this regard, for this study, the first principal component, PC, explains 60.1% of the variability and the second principal component, PC, 17.1%, for a total of 77.2% of the accumulated variance, which indicates significant discrimination between the behaviour of the evaluated families from the two locations.

In relation to Table 3, the largest contributions in component 1 were for financial capital (FC) with 25.34%, natural capital (NC) with 20.57%, and human capital (HC) with 20.24%. It is important to mention that FC highlights the low availability of cash, savings, and links to financial entities, due to the limited administrative culture of money and high investment through informal money loans to recover the diversity of NC, among which is the use of chemically synthesised fertilisers for soils with low profitability. HC has been relevant to this, with training processes according to the problems addressed, achieving appropriation of knowledge with actions such as water harvesting, preparation of organic fertilisers, production and marketing skills.

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Table 2. Indicators of empowerment

Item	Category	Subcategory
Diagnostic evaluation	Economic resources	Economic capital
		Economic income
		Land owned
	Human resources	Management knowledge (generational relief)
		Technical knowledge (especially in agriculture and administration)
		Analysis capacity
		Self-esteem
	Socio-political resources	Ability to organise resources
		Participation in solidarity entities
		Participation in social policy
Contribution of interventions	Economic resources	Technology availability
		Task relief
		Buildings
	Human resources	Accompaniment by family members
		Tangible support from family members
		Exchange of knowledge
	Socio-political resources	Organisational support
		Structural support
		Network support
Results	Have	Profit increase
		Technology booster
		Family time optimisation
	Know	Critical capabilities
		Conflict resolution
		Training level
	Want	Self-esteem increase
		Mastering fears
		Reinforcement of values
	Can	Capacity for organisation
		Administrative capacity
		Capacity for negotiation
Impact	Have	Economic activities
		Family benefits
	Know	Ability to choose
		Local politics
	Want	Increased self-esteem
		Achievement of family projects
	Can	Increased capacity for expression
		Increased participation

Source: Adapted from Charlier et al. (2007)

Table 3. Contribution of capital to components 1 and 2

CAPITAL	Component 1	Component 2
Human	20.24	7.64
Social	14.26	56.19
Natural	20.57	0.75
Physical	19.59	28.62
Financial	25.34	6.81

Source: own study

Component 2 explains 17.1% of the total variability, the contribution of social capital (SC) stands out with 56.19%, and physical capital (PC) is 28.62%. According to the analysis, most of the families highlighted the importance of working both in networks at the local level and with external agents, as well as their involvement in governance processes. These aspects have gone together with FC, taking into account that most of the families have their land and they have established improvements in housing and production areas. Also, concerning local and national roads, the central area has advantages over peripheral areas in relation to quality and maintenance.

Figure 1A shows that the families evaluated in the two study areas are widely dispersed, meaning that families from the same environments have different life strategies regarding their

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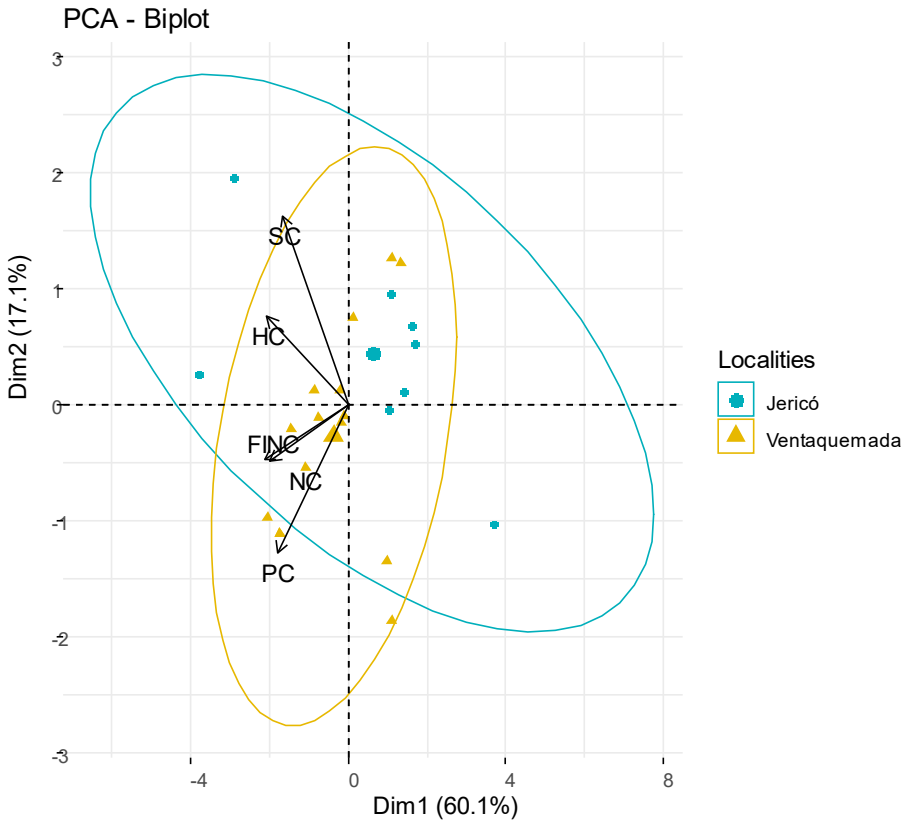

Figure 2. Principal component analysis (PCA) of livelihoods in Ventaquemada (V) and Jericó (J)
Source: own study

capacities and activities, and the human, social, natural, physical, and financial resources necessary to sustain life, according to Yang et al. (2021). In this graphic way, it is easier to explain, holistically, the local realities of their life strategies (Manlosa et al. 2019). Additionally, the relationship between the families of Jericó (J) 5 and 8 stand out due to the high averages in the ML pentagon, where J8 obtained an average of 2.72 because of its strong relation to human, physical, and financial capital with the highest scores (3), followed by social capital (2.6), and then the lowest, natural capital (2). J5 obtained an average of 2.53 for their capital, with physical and social capital standing out with 3, followed by physical capital with 2.66, natural capital with 2.25, and lastly financial capital with 1.75. These families' closest relationship coincided in human capital, where both intergenerational change and permanent training on issues specific to agricultural activities have been relevant, as opposed to the families' weakest relationships, such as financial and environmental capital.

The relationship between families V11, V7, and V6 in Ventaquemada (V) is visible. V11 is notable with 2.38, highlighting its relationship with physical capital (2.67), natural and human capital (2.5), financial capital (2.25), and social capital (2). This means that currently V7 and V6 coincided on physical, human, and natural capital, and, to a lesser extent, social and financial (2). In this regard, the two families have a stronger relationship with physical capital, considering the availability of land for agricultural work, and the quality of private infrastructure and access roads. They also coincided on weak relationships for social capital, due to the few internal and political work networks, an aspect which, in the case of V6 and V7, was added to financial capital because of the low availability of savings.

When comparing V1 and V5, these families' relationships coincided on human capital (2.5) and natural capital (2), by linking training to the rational management of natural resources, with activities such as use of organic fertilisers and harvesting water. Similarly, the relationship with human, social, and natural capital is highlighted for groups V15, V12, V10, V9, and V8, through the association of work networks with capacity building as strategies in issues such as intergenerational handover. In the grouping V3, V13, J2, V4, J4, J9, J7, J6 and J3, families stand out to a lesser degree, mainly in human capital and financial capital.

Figure 1B allows us to visualise the contribution of each type of capital to the localities. In this way, the correlation between social capital and human capital is evident; these aspects are inherent to the human condition, which, in this research, were highlighted through the articulation of local networks with the Community Action Board in Ventaquemada and the Alfalfa Association.

On the other hand, these aspects stand out in the grouping of physical, financial, and natural capital, which visualise the material component which communities have developed as a reflection of the contributions of social and human capital according to their ability to organise interaction and knowledge, established as human development, and based on the level of empowerment established through having, knowing, wanting, and power.

As for natural capital, it has made the least contribution to the localities regarding livelihood, due to the degradation of resources such as soil and water as a consequence of decontextualised technological packages. This capital is highly correlated with financial and physical capital, which explains how the utilisation

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of natural resources implies greater investment in their recovery and the optimisation of infrastructures to mitigate their loss, with strategies such as water harvesting, waste recycling, and diverse agricultural production.

Figure 2 shows the relationship between capitals and families, and shows a high level of association between social and human capital. Some factors associated with natural, physical, and financial capital are poorly connected to land availability, diversity, savings availability, and links to financial institutions. These aspects are weaknesses in the communities, mainly due to the utilisation of natural resources and the lack of a savings culture as support in the event of outcomes or investment processes.

By integrating the livelihoods of the two localities as the basis of local empowerment, it has been established that physical capital (referenced in this research by access to land as being the main source of work, and private and public infrastructure), presented the highest averages largely due to the fact that family production is carried out on their land and housing conditions are adequate, depending on each community. However, it has also been highlighted that aqueduct and sewerage conditions for populations located on the periphery are not adequate, despite the community's management. In this regard, the community in the central area has better conditions for basic services, due to community management and government administration, however, the sewage service is deficient and can be a source of contamination; likewise, the quality of water does not meet the minimum requirements. This first type of capital refers to social inequalities within rural communities, as a consequence of government discrimination, which has generated poverty and social exclusion, as mentioned by the UN and ECLAC (Presbich 2016).

It has been highlighted that social capital is related to human capital through the articulation of local and external work networks as well as participation in governance processes, aspects which have been strengthened through training on topics which have contributed to the diversification of production, intergenerational change, and marketing options in view of the advantages resulting from the private and public infrastructure established as physical capital. This aspect stands out in communities in downtown areas, as they are located between main roads of good quality, in contrast to the location of the peripheral communities, surrounded by roads in poor condition, which makes it distant and also generates higher marketing costs, aspects which are detrimental to the quality of the region's products.

At a certain level, human capital has aimed at strengthening its work for the sake of the sustainability of natural, social, and economic resources, in accordance with the particular interests of families – through strengthening cognitive abilities to achieve competencies in conflict resolution, agricultural processes, breeding patterns, and marketing. This aspect rescues the idea of the need to strengthen the capacities of people through local resources and political processes which allow for autonomy in decision-making, according to the organisation of resources (Scoones 2009).

In this sense, the integration of empirical knowledge and that of different areas of knowledge is a strategy to strengthen the intergenerational relay, through life projects transformed into business or teamwork ideas according to capacities, skills, and individual strategies. Thus, human, sociocultural, and environmental resources, as well as teamwork, have contributed to the evolution of traditional techniques in production and marketing through the dialogue of knowledge between adults and young people as well as between producers and academics – together facing problems such as climate change, for which strategies such as water harvesting and composting of animal and vegetable waste have been consolidated on the ground, contributing to the quality of production and cost reduction as well as food security.

In terms of localities in central and peripheral areas, the interaction of ML in issues such as resilience is evident through the identification of factors which contribute to the evolution of local skills. This is the reason why the strengthening of financial and natural capital is required to achieve sustainability processes at the locality level, in an articulated manner and with the rational management of natural resources, since both areas currently enjoy the peak of these resources and require progress on issues such as diversification in production, transformation, and marketing of production, which depend equally on human, social, natural, physical, and financial capital (Heilbrunn & Lannone 2020).

The previous contribution goes hand in hand with sustainable development by making visible the well-being of the inhabitants within their surroundings, where well-being is based on the analysis of livelihood capital, so as to relate them in a contextualised and systemic manner, as established and contextualised by Velázquez and Aguilar (2012). In this regard, strategies such as permanent training on issues established by the communities, linkage to intergenerational work networks, and transformation of raw materials for the commercialisation of products from peripheral areas, thus ensuring quality and a real return on the investment, become relevant and are carried out through short marketing chains which favour small producers interested in maintaining their identity within rural localities.

In this way, the social value of the ML approach is related to the structure and exercise of community empowerment, taking into account family particularities which make it possible to demonstrate the relevance of work networks and the development of capacities at the community level, human and technical, through training. This is so that poverty is minimised with contextualised educational strategies (Paa-Kwsi 2019) to strengthen intergenerational change and so that diversified production alternatives are strengthened with a sociocultural sense as well as with leadership in family and community decision making.

Analysis of the level of empowerment of rural communities as a social process in Boyacá

As empowerment becomes relevant in programs, projects, and movements as a strategy for social transformation through human capital, it makes it possible to evidence the evolution of people through psychological and material processes at the individual and collective level as well as intergenerationally. These aspects favour decision-making in accordance with the competencies and life projects which have been established based on the financial, material, technical, human, and technological resources; training; education; and leadership. It is relevant to mention the need for interdisciplinary and technical strategies to support human development and social sustainability, so that the empowerment established by livelihoods contributes to sustainable development (Jaka & Shava 2018).

Ventaquemada empowerment

These families were compared and grouped together in relation to the established categories for empowerment. From this bootstrap-based clustering analysis (Figure 3), in the left lateral dendrogram it can be observed that the families are robustly divided into two large groups. The first includes families F9, 4, 2, 6, 5, and 3, while the second has two intermediate groups, one composed of F10 and the other by F15, 14, 1, 12, 11, 8, 13, and 7. The grouping is determined by the scale of the empowerment subcategories. In the upper dendrogram, two

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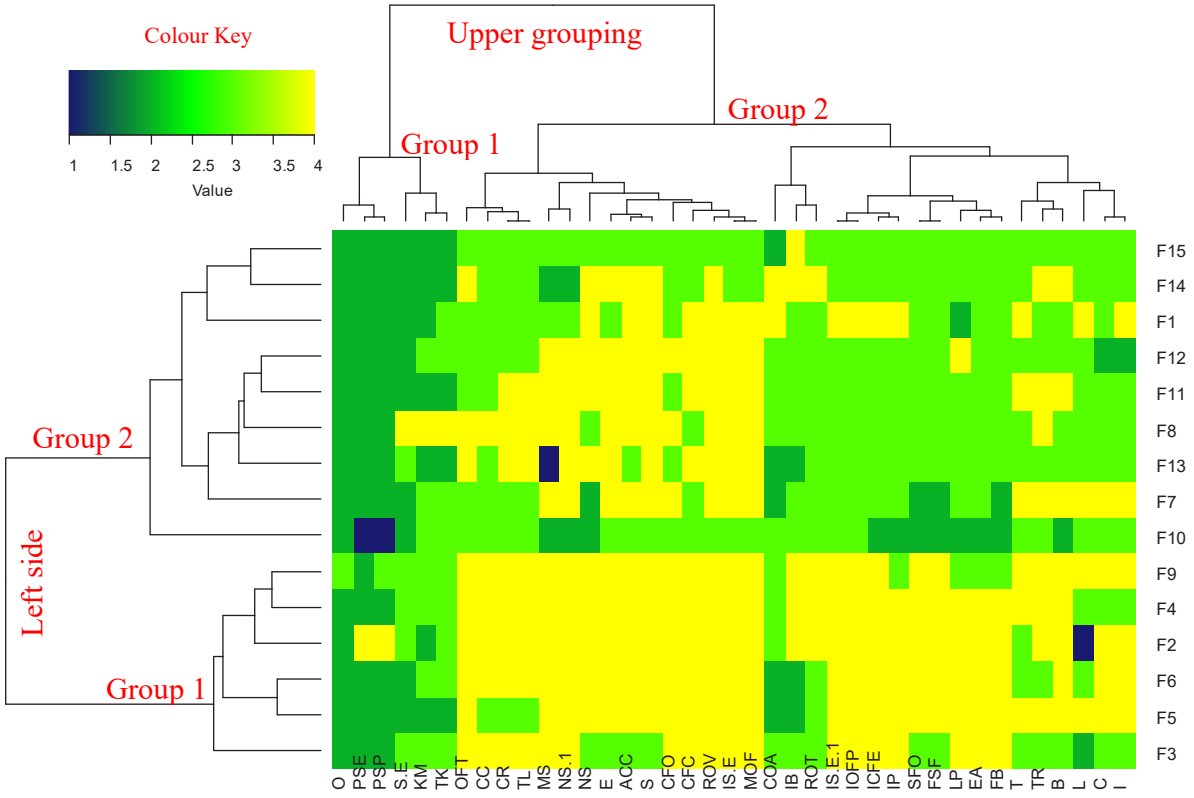

Figure 3. Bootstrap analysis of empowerment in Ventaquemada according to Ward's method. Organisation (O), participation in solidarity entities (PSE), participation in social policy (PSP), self-esteem (S/E), knowledge of management (KM), technical knowledge (TK), optimisation of family time (OFT), critical capacities (CC), conflict resolution (CR), training level (TL), management skills (MS), negotiation skills (NS), network support (NS), exchange (E), accompaniment (ACC), support (S), capacity for organisation (CFO), capacity for choice (CFC), reinforcement of values (ROV), increase in self-esteem (IS/E), mastery of fears (MOF), capacity for analysis (COA), increase in benefits (IB), reinforcement of technology (ROT), implementation of family projects (IOFP), increased capacity for expression (ICFE), increased participation (IP), support for organisation (SFO), support for structure (SFS), local policies (LP), economic activities (EA), family benefits (FB), technology (T), task relief (TR), buildings (B), land (L), capital (C), income (I), increased self-esteem (IS/E)
Source: own study

groups can be observed; the first is composed of categories such as organisation, participation among supporters, participation in politics, self-esteem, and knowledge of management, while the second group presents two subgroups.

The first of these groups is made up of the categories of technical knowledge, family time optimisation, critical skills, conflict resolution, management skills, negotiation skills, network support, exchange, accompaniment, support, organisation skills, choice skills, reinforcement of values, increased self-esteem, and mastery of fears, and has a stronger relationship with the first group from the left lateral dendrogram, except for some categories in family 3 and 5. For the second subdivision of the of the upper dendrogram – which is made up of analysis capacity, increased benefits, reinforcement of technology, increased self-esteem, carrying out family projects, increased capacity for expression, increased participation, support for organisation, and support for structure – local policies, economic activities, family benefits, technology, relief of tasks, buildings, land, capital, and income continue to be higher in the first division of the right lateral dendrogram than in the second, except for land capacity, whose value tends towards 1 in F2.

Jericó Empowerment

In the colour map for the municipality of Jericó (Figure 4), the left lateral dendrogram identifies two groups of families which were part of the investigation. The first group is made up of families 9, 6, 1, and 7; while the second group is made up of families 4, 2, 3, 8, and 5. Secondly, the upper dendrogram divided the variables into two large groups; the first group is made up of capacity for analysis, technical knowledge, self-esteem, participation in social policy, participation in solidarity entities, knowledge of management and organisation; while the other group is made up of the remaining variables. The first group of variables had homogeneous values for the two-family groups, while the second group of variables had differences between the families, grouping into one block of yellow colour and the other green (Figure 4).

The relevance of livelihoods in the empowerment of communities is determined according to the integration of economic aspects, social inclusion, and responsible management of the environment; however, when addressing local communities, different difficulties are evident in achieving this synergy, despite having training and work networks, due to production factors, such as monocultures, facing economic needs which have led to

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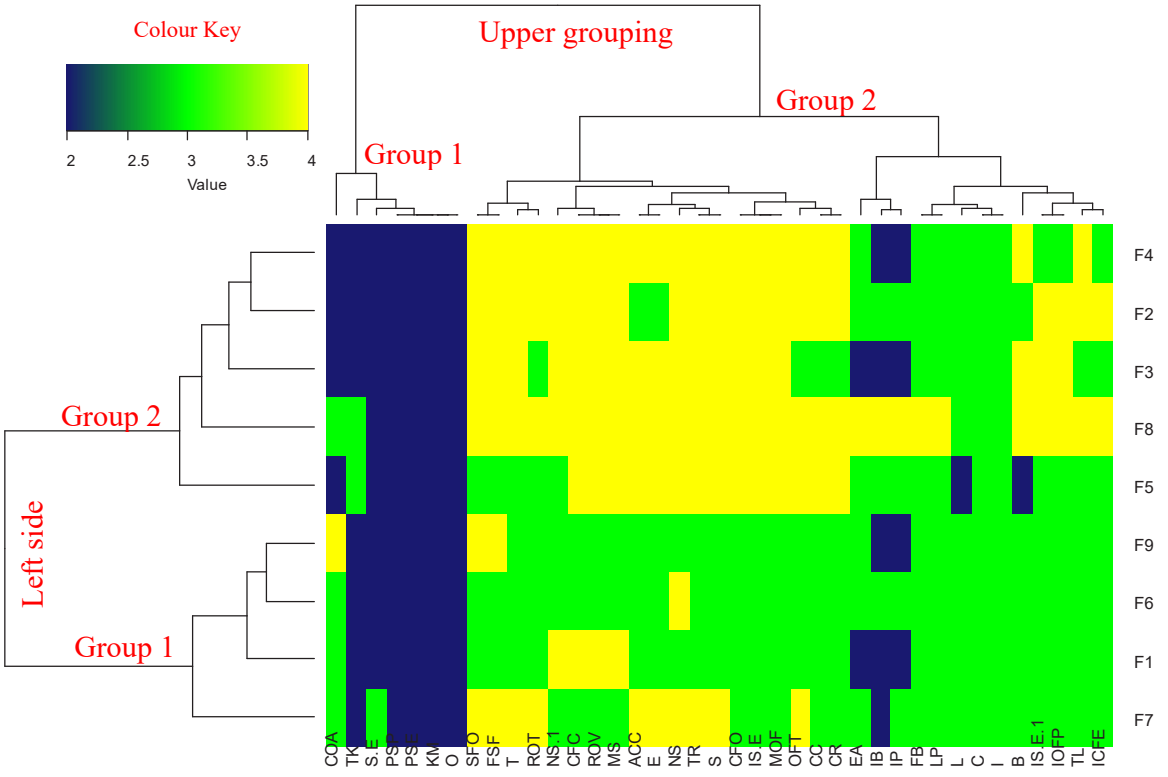

Figure 4. Bootstrap analysis of the empowerment of the families of Jericó according to Ward's method
Source: own study

the expansion of the agricultural frontier which has affected the flora, fauna, soil, and water sources.

Empowerment assessed through diagnosis allows the contribution of economic, human, and socio-political resources to be made visible; but empowerment can also be assessed through the results and impact of having, knowing, wanting, and being able to. These aspects are influenced by the geographical location of the local communities. In this regard, the peripheral zone's lower level of empowerment was notable, which was due to, according to the diagnosis, low organisation, participation in solidarity entities, and participation in the social policy established as socio-political resources. Likewise, the same applied to human resources, due to a low capacity for analysis, theoretical knowledge, self-esteem, and management knowledge. Additionally, aspects which reflect the need for a greater commitment to community work, the appropriation of knowledge, a link with government management, and personal assessment, allow for joint efforts to achieve actions in comprehensive management at an interdisciplinary and interinstitutional level within the framework of governance and territorial governability.

Similarly, among the aspects which contributed to the empowerment of communities, particularly at the family level, is the optimisation of shared time, the reinforcement of values, the increase in self-esteem and the control of fears. The commitment of women at the domestic and productive levels stands out – aspects which have been highlighted by Misra (2006) and Miedema et al. (2018) – which agrees with what was found in this study, where in the central zone it has been women who have taken the lead in productive diversification, marketing strategies, community participation, and training in different areas. In the peripheral zone, women have been less involved in these aspects due to the high percentage of women dedicated to domestic work.

At the community level, actions that contribute to empowerment have been identified, such as technical knowledge, critical skills, conflict resolution, management skills, negotiation skills, network support, exchange, accompaniment, organisation skills, choice skills, and reinforcement of values. In this way, an increase in the self-esteem of individuals will have been achieved by carrying out family projects, aspects which have allowed for an increase in expression and participation, support for organisation, analytical capacity, and decision-making for the reinforcement of technology and local policies for sociocultural identity. These aspects of empowerment, according to Sulemana et al. (2019), are relevant for poverty reduction, since they make it possible for the need for comprehensive strategies at a the social, cultural, and technical level to be made visible in a depoliticised manner.

It can therefore be established that the empowerment of communities allows them to transform their traditional livelihoods into sustainable ones. This reference requires the combining of interdisciplinary efforts which allow a greater number of intergenerational achievements in psychological aspects (Shuai et al. 2019) in a way which strengthens issues such as self-esteem and the optimisation of family time, as well as leadership in decision-making so that advances in the well-being of individuals are progressive.

Conclusions

From the point of view of the relationship between livelihoods and community empowerment in Boyacá, it can be said that at the level of the areas located in the centre and on the periphery of the department, the direct link between ML at the family level and community empowerment is evident, and identifies the factors

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which have contributed to the evolution of local competences through the integration of social, human, natural, and physical capital to achieve sustainability processes according to local contexts.

Principal components analysis (PCA) has been established as a descriptive statistical tool which can estimate the degree of correlation between capital and territorial actors. In this study, strong correlations have been established between natural and financial capital, while the most important capital in the community, social capital, has been identified as a fundamental element for the construction of the social fabric and the economic strengthening of the region.

The communities have family and community strategies to re-diversify resources, according to natural capital, as a fundamental issue which requires progress on matters such as diversification in production, transformation, and marketing of productions, in interaction with other capital (social, human, physical, and financial). In this regard, the need for production planning is highlighted according to the vocation of the soils in each region, for which government plans, based on governance, are required, but taking into account the fact that social capital is related to the structure and exercise of community empowerment.

Significant changes are highlighted in empowerment in rural communities, the development of traditional to sustainable life strategies based on HC through training and intergenerational change established in interaction with CS, according to networks of internal and external agents, which has led to the strengthening of NC by diversifying agricultural production and soil recovery through ancestral techniques such as organic fertilisers and water harvesting. These have strengthened PC through adjustments in private infrastructure through the construction of reserve tanks and disposal areas for vegetable and animal raw materials for composting.

In relation to the bootstrap analysis, it has shown that the population of Ventaquemada demonstrated a pattern of behaviour which is in accordance with the categories established for empowerment, within which two groups of people were identified who were articulated with solid strategies for capacities such as organisation, organisation in social policies, participation in solidarity entities, and technical knowledge. In the case of the municipality of Jericó, a totally different behaviour was presented, since the categories which showed advantages in the community of Ventaquemada, were the main weaknesses in the community of Jericó.

The research on the integration of livelihoods as the basis for local empowerment establishes that there are several causes of the crisis in the agricultural sector in Colombia, among which is the disarticulation of production systems and the lack of experience of the producers, for which the methodological approach of livelihoods facilitates the valuation of human, social, physical, natural, and financial capital; however, it is pertinent to mention that they need to be integrated according to local contexts, strategies, and results, as a contribution to their sustainability.

It is notable that the empowerment of families in areas such as the optimisation of shared time and reinforcement of values, increased self-esteem and control of fear. Similarly, at the community level in relation to technical knowledge, critical skills, conflict resolution, management skills, negotiation skills, network support, exchange, accompaniment, organisation skills, choice skills, and reinforcement of values.

Contributions

Conceptualisation: NZP-L, MAG-P; methodology: NZP-L, MAG-P, RAC-C; software, RAC-C, MAG-P, JMJ-S; validation: LAC-R, JCH-C; formal analysis: LAC-R, JCH-C, JMJ-S; investigation, NZP-L, MAG-P, RAC-C, LAC-R, JCH-C, JMJ-S. All authors have read and agreed to the published version of the manuscript.

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